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An Advanced ATM Crime Prevention System

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Abstract:

The Idea of Designing an Advanced ATM Crime Prevention System is born with the observation of ATM crime incidents happening around the world.

This paper deals with the prevention of ATM crime. Whenever robbery occurs, MEMS sensor is used here which senses movement produced from ATM machine. This system uses ARM controller based embedded system to process real time data collected using the MEMS sensor. Once the movement is sensed the beep sound will occur from the buzzer. DC Motor is used for closing the door of ATM. Stepper motor is used to leak the gas inside the ATM to bring the thief into unconscious stage.RTC used to capture the robber occur time and send the robbery occur time with the message to the nearby police station through the GSM. At the same time this system also deals with the safety of the customer by alerting the surrounding people and nearby police station whenever the customer is in dangerous situation. Here, Keil tools are used to implement the idea and results are obtained.

This system will prevent the crime and the person involving in crime can be easily caught.

Index Terms- ARM controller-LPC2148, MEMS Sensor, GSM Technique, HM 2007, DC Motor, Stepper motor, Buzzer, Keil Tool.

I.INTRODUCTION

Today, ATM has become an irreplaceable communication and service channel between banks and cardholders due to its fast, convenience and human resource saving advantages; since the introduction of the first automated teller machine (ATM) in 1967, perpetrators have been devising ways to try to steal the cash inside. Because ATMs eliminate the need for round-the clock human involvement and tend to be located in places that make them more vulnerable to attack. According to estimates by Retail Banking Research, there are more than 2.2 million ATMs deployed worldwide. This is a figure forecasted to exceed 3 million by 2016. As the number of ATMs in use increases, so do the frequency and sophistication of security threats, making the development of crime prevention measures a top priority for financial institutions (FIs) and ATM manufacturers.

But with the prosperity of installed ATM, the reported ATM crime also has been dramatic grown (Figure 1), causing big loss for cardholders and banks. To build safe ATM use environment, maintain bank's brand image and protect bank assets, all the involved organizations, institutions, and persons must research, develop and takes measures to meet the challenges faced by ATM crimes.

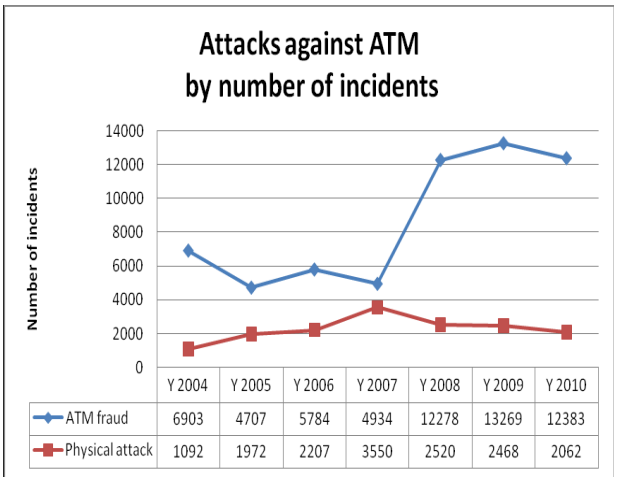

FIGURE 1: ATM RELATED ATTACKS. SOURCE: EAST

The above statistics necessitates the implementation of ATM crime prevention system. Therefore, this paper suggests the method of providing security to both the ATM and the customers whoever using ATM services. So by using the GSM technology, MEMS sensor, DC Motor, Stepper Motor, Voice recognizing module the theft can be easily caught. Here DC Motor is used to close the door of the ATM and stepper motor is used for emit gas and bring the thief into unconscious stage.HM2007 (voice recognizing module) used here to alert the surrounding people and nearest police station whenever the customers are in dangerous situation.

II.PROPOSED SYSTEM

A. Architecture of the proposed system:

The architecture of the proposed system is shown in Figure2.When the MEMS sensor detects any movement of ATM ,it sends a signal to the LPC 2148 via GPIO pins.whenever the received signal level is greater than the threshold value then controller activates the output devices such as dc motor,stepper motor,buzzer and GSM.DC motor closes the door of the ATM and stepper motor emits the gas which brings the thief into unconscious state.At the same time buzzer gives continuous beep sound and message will be send to the nearest police station via GSM module. When the DSP HM2007 recognizes the speech then the controller activates the voice annuciator and GSM module. The voice annunciator gives a continues voice message which will alert the surrounding people and gsm alerts the nearest police station by sending a message that the customer is in dangerous situation.

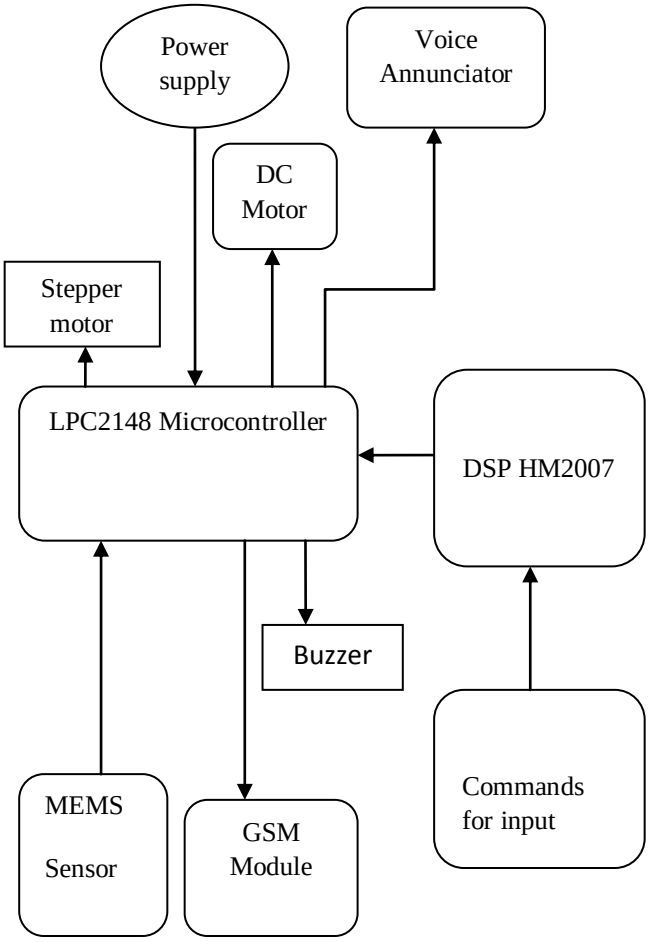

FIGURE 2: A SAMPLE BLOCK DIAGRAM EXPLAINING THE PRINCIPLE OF PROPOSED SYSTEM

B. Working of the proposed system with the help of flow chart:

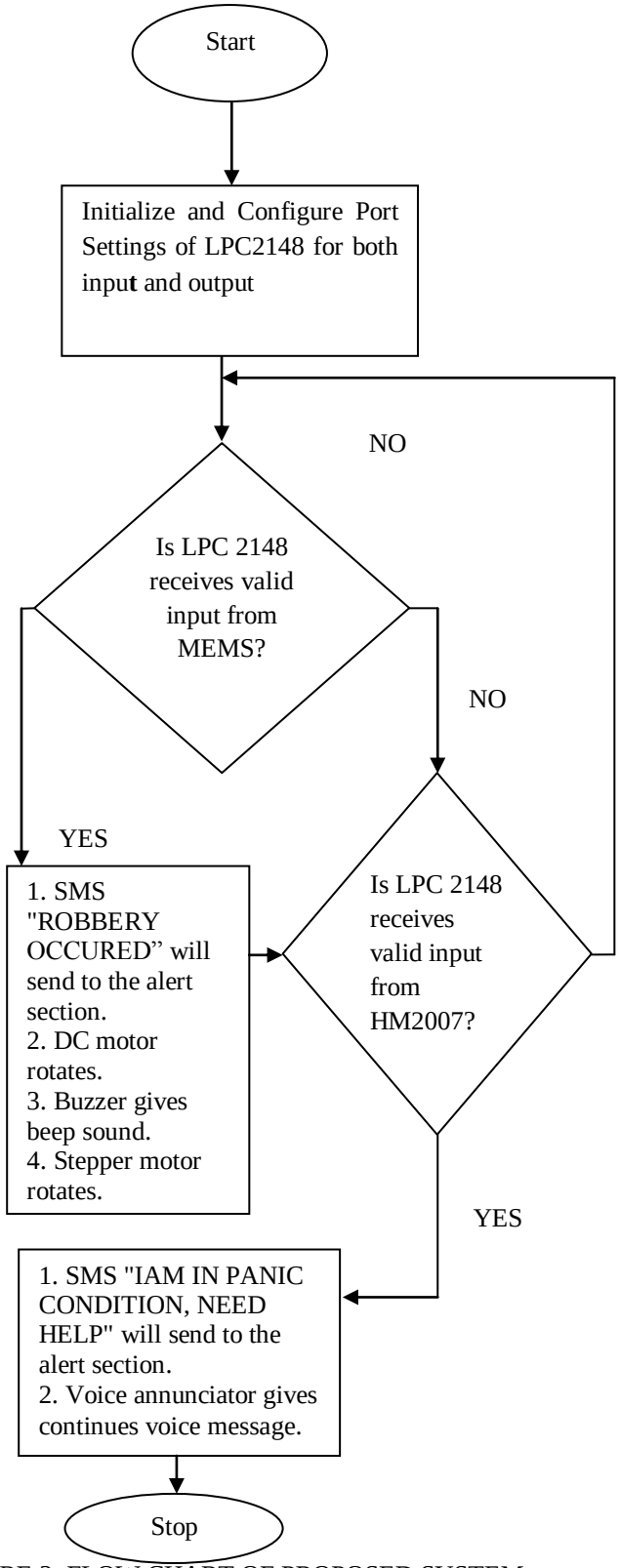

FIGURE 3: FLOW CHART OF PROPOSED SYSTEM

When the LPC 2148 receives valid input from MEMS then the following sequence of events takes place.

(i).An SMS "ROBBERY OCCURRED" will send to the nearest police station.

(ii).DC motor closes the door of the ATM.

(iii).Buzzer gives continuous beep sound.

(iv).Stepper motor emits the gas which brings the thief into unconscious state.

If the controller does not receive any valid input from MEMS then it checks the input from HM2007.When the controller LPC2148 receives valid input from HM2007 then an SMS "IAM IN PANIC CONDITION, NEED HELP" will send to the nearest police station and the voice annunciator gives continues voice message to alert the surrounding people. If it does not receive any valid input from HM2007 then the controller again checks for the MEMS signal.

III.HARDWARE MODULES

A.Power Supply: LPC2148 works on 3.3 V power supply. LM 117 can be used for generating 3.3 V supply. However, basic peripherals like LCD, ULN 2003 (Motor Driver IC) etc. works on 5V. So AC mains supply is converted into 5V and after that LM 117 is used to convert 5V into 3.3V.

B.ARM7 LPC 2148 Development Board: LPC2148 Pro Development Board is a powerful development platform based on LPC2148 ARM7TDMI microcontroller with 512K on-chip memory. This board is powered by USB port and does not need external power supply. It is ideal for developing embedded applications involving high speed wireless communication (Zigbee / Bluetooth / WiFi), USB based data logging, real time data monitoring and control, interactive control panels etc. The on-chip USB controller provides direct high speed interface to a PC/laptop with speeds up to 12Mb/s. The UART boot loader eliminates need of an additional programmer and allows you to program using serial port. The on board peripherals include SD/MMC card interface, USB2.0 interface, 4Kbit I2CEEPROM, Xbee / Bluetooth / WiFi wireless module interface, ULN2003 500mA current sinking driver, L293D DC motor controller, 16X2 character LCD and many more. The on-chip peripherals and the external hardware on the development board are interconnected using pin headers and jumpers. The I/O pins on the microcontroller can be accessed from a 50 pin male header. This direct access to I/O pins enables you to connect your own devices very easily to the processor.

FIGURE 4: ARM7 LPC 2148 DEVELOPMENT BOARD

C.MEMS Sensor: A MEMS (**Micro-Electro- Mechanical Systems**) features a three dimensional movable structure that can be moved mechanically and is configured on a silicon substrate along with various circuits.Sisgeo's MEMS tilt sensors are accelerometers and measure the **component of earth's gravity** in the measuring direction. This means that the output is proportional to 1g * SIN (alpha), where "alpha" is the inclination angle relative to the 0g position. The main principle of the acceleration sensor is as follows: the weight, which is supported by the spring, moves in accordance with the acceleration speed, and this motion is electrically detected in terms of the change in the capacitance value between the weight and the cap.The highest accuracy is available with last MEMS series that use differential measurement principle able to compensate all common mode error and noise effects.All Sisgeo MEMS based instruments have a built-in NTC thermistor to measure also temperature value during readings.MEMS based sensor products provide an interface that can sense, process and/or control the surrounding environment. MEMS-based sensors are a crucial component in automotive electronics, medical equipment, hard disk drives, computer peripherals, wireless devices and smart portable electronics such as cell phones and PDAs.

Benefits of MEMS:

- Low Cost
- Low Power
- Miniaturization
- High Performance
- Integration

D.HM2007: The HM2007 Speech Recognition IC performs speech recognition independently in a stand alone mode, or it can function as a slave to a host processor in CPU mode. In stand alone mode, the circuit can recognize up to 40 words lasting one second each. The chip provides the options of recognizing either forty .96 second words or twenty 1.92 second words. This circuit allows the user to choose either the .96 second word length (40 word vocabulary) or the 1.92 second word length (20 word vocabulary). For memory the circuit uses an 8K X 8 static RAM.

The chip has two operational modes; manual mode and CPU mode. The CPU mode is designed to allow the chip to work under a host computer. This is an attractive approach to speech recognition for computers because the speech recognition chip operates as a co-processor to the main CPU. When the HM2007recognizes a command it can signal an interruptto the host CPU and then relay the command code. The HM2007 chip can be cascaded to provide a larger word recognition library. The speech recognition system is a completelyassembled and easy to use programmable speech recognition circuit. Programmable, in the sense that you train the words (or vocal utterances) you want the circuit to recognize. This board allows you to experiment with many facets of speech recognition technology. It has 8 bit data out which can be interfaced with any microcontroller for further development.

FIGURE 5: HM 2007(VOICE RECOGNITION MODULE)

E.DC Motor: This DC or direct electric current motor works on the principal, when a electric current carrying conductor is placed in amagnetic field, it experiences a torque and has a tendency to move. This is known as motoring action. If the direction of electric current in the wire is reversed, the direction of rotation also reverses. When magnetic field and electric field interact they produce a mechanical force, and based on that the working principle of dcmotor established. The direction of rotation of a this motor is given by Fleming's left hand rule, which states that if the index finger, middle finger and thumb of your left hand are extended mutually perpendicular to each other and if the index finger represents the direction of magnetic field, middle finger indicates the direction of electric current, then the thumb represents the direction in which force is experienced by the shaft of the dc motor.

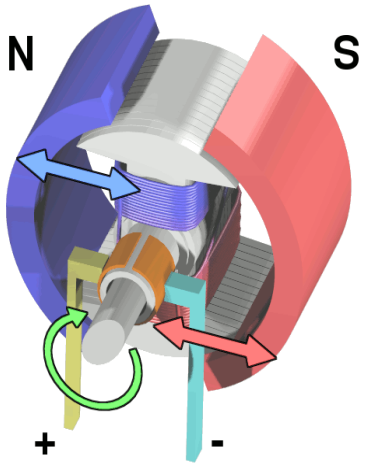

FIGURE 6: DC MOTOR

F.Stepper Motor: A stepper motor is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any feedback sensor (an open-loop controller), as long as the motor is carefully sized to the application.Switched reluctance motors are very large stepping motors with a reduced pole count, and generally are closed-loop commutated.

DC brushed motors rotate continuously when voltage is applied to their terminals. The stepper motor is known by its important property to convert a train of input pulses (typically square wave pulses) into a precisely defined increment in the shaft position. Each pulse moves the shaft through a fixed angle. Stepper motors effectively have multiple "toothed" electromagnets arranged around a central gear-shaped piece of iron. The electromagnets are energized by an external control circuit, such as a microcontroller. To make

the motor shaft turn, first, one electromagnet is given power, which magnetically attracts the gear's teeth. When the gear's teeth are aligned to the first electromagnet, they are slightly offset from the next electromagnet. So when the next electromagnet is turned on and the first is turned off, the gear rotates slightly to align with the next one, and from there the process is repeated. Each of those rotations is called a "step", with an integer number of steps making a full rotation. In that way, the motor can be turned by a precise angle.

FIGURE 7: STEPPER MOTOR

G.GSM Module: This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily.The modem can either be connected to PC serial port directly or to any microcontroller through MAX232. It can be used to send and receive SMS or make/receive voice calls. It can also be used in GPRS mode to connect to internet and do many applications for data logging and control. In GPRS mode you can also connect to any remote FTP server and upload files for data logging.This GSM modem is a highly flexible plug and play quad band **SIM900A** GSM modem for direct and easy integration to RS232 applications. Supports features like Voice, SMS, Data/Fax, GPRS and integrated TCP/IP stack.

FIGURE 8: GSM MODEM

H.Buzzer: A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke. A joy buzzer is an example of a purely mechanical buzzer. Early devices were based on an electromechanical system identical to an electric bell without the metal gong. Similarly, a relay may be connected to interrupt its own actuating current, causing the contacts to buzz. Often these units were anchored to a wall or ceiling to use it as a sounding board. The word "buzzer" comes from the rasping noise that electromechanical buzzers made. A piezoelectric element may be driven by an oscillating electronic circuit or other audio signal source, driven with a piezoelectric audio amplifier. Sounds commonly used to indicate that a button has been pressed are a click, a ring or a beep.

FIGURE 9: BUZZER

I.Voice Annuciator: Voice annunciator produces excellent sound quality from pre-recorded MP3 files. The compact size allows panel mounting for even tight-fitting panels, with the integrated look for most any application and programming it is easily accomplished with Patlite's SD card

(sold separate) and Patlite's free (downloadable) programming software.

IV. SOFTWARE IMPLEMENTATION

For the software implementation, we deploy two software packages. First one is the Keil µVision 4.0. Second one is the Flash magic simulator. The Keil µVision Debugger accurately simulates on-chip peripherals (I^2C, CAN, UART, SPI, Interrupts, I/O Ports, A/D Converter, D/A Converter, and PWM Modules) of ARM7device. Simulation helps to understand hardware configurations and avoids time wasted on setup problems. With simulation, we can write and test applications before target hardware is available. The system program written in embedded C using KEIL IDE software will be stored in Microcontroller. Keil development tools for the Microcontroller Architecture support every level of software developer from the professional applications engineer to the student for learning about embedded software development. The industry-standard Keil C Compilers, Macro Assemblers, Debuggers, Real-time Kernels, Single-board Computers, and Emulators support all ARM7 derivatives.The Keil Development Tools are designed to solve the complex problems facing embedded software developers.

Flash magic is used to dump the code to microcontroller from PC. Flash Magic is a free, powerful, feature-rich Windows application that allows easy programming of Philips FLASH Microcontrollers. The Flash Memory In-System Programmer is a tool that runs under Windows 95/98/NT4/2K. It allows in-circuit programming of FLASH memories via a serial RS232 link. Computer side software called Flash Magic is executed that accepts the Intel HEX format file generated from compiler Keil to be sent to target microcontroller. It detects the hardware connected to the serial port.

V.CONCLUSION

As we all know, these days most of the ATMs have been attacked by the robberies. From the first ATM being installed in the world till now, ATM has gradually become a target of crimes.While with the constantly evolving of reported ATM crime ATM industry has begun to pay attention to the safety of ATM, even cardholders.

This paper demonstrates how an automation of ATM crime prevention can be implemented using GSM technology, LPC2148 microcontroller, MEMS sensor,dc motor, stepper motor, HM2007, buzzer with keil micro vision 4.0 in ATM Machines center.

By implementing this project we can easily prevent the crime and also we can save our precious time.

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